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## Memorandum on Tea Experiments Conducted by the Department of Agriculture, F.M.S. & S.S.

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*This memorandum was prepared for a special meeting of the Advisory Committee which was held at the Offices of the Department of Agriculture on the 28th November, 1928 to consider the possibilities of tea cultivation in Malaya and whether it was necessary for the Department to carry out any further experiments with tea other than those now being undertaken.*

*Several experienced tea planters, in addition to members of the Advisory Committee, were invited to attend this meeting and give the committee the benefit of their advice as to the possibility of growing tea both on the plains and the highlands in this country.*

*While the majority of the committee was in favour of the general development of tea planting in the highlands it was decided that the potentialities of the lowlands should be thoroughly investigated and that the experimental work already in progress at the Experimental Plantation, Serdang be extended where possible.*

### Introductory.

In January, 1914 the Director of Agriculture circularised several well-known planters, experienced in tea planting, with a view to obtaining their services for the purpose of inspecting and reporting on the suitability for tea cultivation of land at Lubok Tamang (3,500 feet above sea level)

in what is now known as Cameron's Highlands. The proposal had, however, eventually to be dropped as it was not found possible to arrange suitable terms with the only planter willing to undertake the journey.

During March, 1914 Mr. M. Barrowcliff, Assistant Agricultural Chemist, paid a visit to this area and explored a portion of the Bertam Valley from the Sungei Renglet to the foot of Gunong Berembun. An account of his visit was submitted to the Director of Agriculture on the 20th April, 1914 under the title "Report on a visit to Cameron's Plateau". Mr. Barrowcliff took a number of soil samples from the land explored and the conclusions he arrived at after discussing and comparing his analyses with some of those of the best tea soils in North-East India were, that the Lubok Tamang samples conformed in every respect to the requirements of a good tea soil and that there was no reason apparent why tea of high quality should not be produced in this locality. Further analyses of the soil samples from Lubok Tamang reported on by Mr. V. R. Greenstreet, Assistant Agricultural Chemist, and published on pages 281-282 of the Malayan Agricultural Journal, Vol. X, September, 1922, supported the opinion expressed by Mr. Barrowcliff.

## Experiments at Gunong Angsi.

At the end of 1914 a small quantity of dark-leaf Manipuri Assam tea seed was obtained through Mr. Thos. More, Manager of Sungei Buloh Estate, Kuala Selangor for trial at the Experimental Plantation, Gunong Angsi. These seeds were sown in nursery beds at the Experimental Plantation, Kuala Lumpur and the seedlings were transferred to Gunong Angsi at the end of 1915 for planting up one acre of virgin land at an elevation of 2,100 feet.

In 1915 a further small quantity of light-leaf indigenous Assam seed, received from the same source, was planted in nursery beds at Gunong Angsi at an elevation of 1,200 feet. The germination of the seed was fairly good and sufficient seedlings were raised for planting up one acre of this variety on a plot adjoining the Manipuri variety at an elevation of 2,100 feet. The area selected was fairly steep and terraces were constructed at about 6 feet intervals. The seedlings were planted on the contour at distances of 4 feet apart during October, 1916.

The growth in each case was quite good and the bushes were pruned back to within about 9 inches of the ground when about one year old. Both lots of plants eventually developed into fair-sized bushes, but no reliable records of the yield of fresh leaf are available.

As this Experimental Plantation was abandoned in 1922 the plots very soon became neglected and the majority of the plants died out.

Mr. T. D. Marsh, Assistant Agriculturist, visited Gunong Angsi on the 7th November, 1928 to inspect this area and found that owing to the growth of blukar and damage by fire the majority of the plants had died out and only about 200 overgrown bushes remained.

A few of the bushes were seeding and it was possible to collect a small quantity of seed, but in view of the small number of plants which exist in this area it is questionable whether it is worth while clearing them up from the point of view of seed production.

### Experiments at the Experimental Plantation, Serdang.

During 1924 an area of about 5 acres of virgin land adjoining the North-West corner of Block 3 was cleared with the object of planting up one-acre plots of four varieties of Assam tea and a one-acre plot of the local Chinese variety. This land is undulating, protected on the North, South and West by secondary jungle, and the soil consists of a friable laterite loam.

In December, 1924 a small consignment consisting of ½ maund seed of the Dangri variety of tea was received from the Dangri and Dhonjan Tea Seed Co. of Dibrugarh, Assam, while a second consignment, consisting of ½ a maund seed of each of the Betjan, Dhonjan and Rajghur varieties, was received from the same source in January, 1925.

The following is a brief description of the four varieties selected for trial at Serdang:—

(1) *Dangri.*—A pure Manipuri jat, derived from the original Manipuri stock. It has a dark leaf, is very hardy and bushes quickly.

(2) *Dhonjan.*—A pure Assam variety, derived from indigenous Assam stock. It has a large dark green leaf, flushes freely and is comparatively hardy.

(3) *Betjan.*—A pure Assam jat, derived from indigenous Assam stock, having a large leaf of medium colour, but not so large as some of the light-leaved varieties. It is a heavy yielder and noted for its large "fat tips".

(4) *Rajghur.*—A cross between a pure Assam and a pure Manipuri plant. It is a high yielder and very hardy.

The Dangri seed, comprising the first consignment, was sown on the 16th December, 1924 and the Dhonjan, Betjan and Rajghur seed, comprising the second consignment, was sown on the 18th January, 1925. Both lots of seed were germinated in boxes and the newly germinated seedlings planted straight out in the field.

The results of germination were as follows:—

| Jat. | Quantity of seed. | No. of seeds received. | No. of seedlings established. | Percentage germination. |
|---|---|---|---|---|
| Dangri | ½ maund ... | 7,256 | 3,700 | 51 |
| Dhonjan | ,, ... | 9,447 | 6,896 | 73 |
| Betjan | ,, ... | 8,168 | 2,858 | 35 |
| Rajghur | ,, ... | 8,325 | 5,078 | 61 |

The low percentage of the seedlings established was due to a large proportion of cracked seeds having germinated in transit.

A commencement was made to lift the seedlings of the Dangri variety from the boxes and transplant them in the field in January, 1925, while the other varieties, Dhonjan, Betjan, and Rajghur were transferred to the field in February and March, 1925.

The distance of planting in the field was 4 feet x 4 feet, giving 2,722 plants per acre.

*Chinese Variety.*—A small parcel containing 5½ lbs. of seed of a Chinese variety of tea was obtained from the 10th mile Cheras, Selangor in December, 1925. This seed was sown in boxes on the 10th December, 1925. From 1,958

seeds comprising this parcel 945 seedlings were raised and these were planted out in the field on the 6th November, 1926 at distances of 4 ft. x 4 ft. square.

The following records show the results of germination tests with seed of the local Chinese variety of tea:—

| Nature of Seed. | | Percentage germination. | Period of germination. |
|---|---|---|---|
| Ripe seed "floaters" | ... | 22 | 52 days. |
| Ripe seed "sinkers" | ... | 64 | 43 ,, |
| Unripe seed "floaters" | ... | 2 | 47 ,, |
| Unripe seed "sinkers" | ... | 42 | 48 ,, |

*Soil Conservation.*—In January, 1925 *Tephrosia candida* was planted between alternate tea plants in alternate rows in order to produce low shade. The subsequent treatment of the green manure plants consisted of periodical pruning of the lower branches so as to form "standards" which would provide auxilliary shade for the young tea bushes.

During October, 1925 the whole area was silt-pitted, the pits being dug 4 ft. x 1 ft. x 1 ft. between the *Tephrosia candida* plants. It was observed later that a certain amount of soil erosion was taking place and extra pits were dug wherever possible.

*Shade.*—In November, 1925 *Gliricidia maculata* was planted on the triangular system in rows 56 feet apart and 40 feet apart in the rows, so as to provide top shade.

*Supplying.*—During November, 1925 the Dangri plot was completely supplied, but there were insufficient plants in the nurseries to supply all the vacancies in the plots containing the other varieties. Further, it was found impossible to obtain an extra supply of seed from Assam to supply the vacancies occurring in these plots.

*Pruning.*—The plants were all pruned back to within about 9 inches from the ground in October, 1926. The bushes were again pruned back in October, 1927 to within 3 inches of the previous cut and in December, 1927 all the small shoots were "hard nipped" in an endeavour to make the bushes spread laterally and thus provide a large number of shoots from which leaf might be plucked later.

Prior to the pruning in November, 1927 a small quantity of leaf was plucked and an attempt was made to cure it, but the absence of any drying apparatus made it difficult to obtain a sample of tea fit for consumption.

At the end of 1927 the *Tephrosia candida* was beginning to die out, consequently it was dug up and the prunings turned into the soil as a green manure.

*Plucking.*—The tea plants were again heavily pruned during August, 1928. This operation was carefully carried out so as to encourage the spreading of the branches and thus give a wide low bush which would facilitate the plucking of the leaf. During the second half of September and the beginning of October the bushes were topped to a low level in order to encourage flushing. On the 12th October, 1928 a regular seven-day round of plucking was commenced and the yields of fresh leaf have been recorded since this date. The growth of these bushes in February, 1929 is shown in Plate I.

*Manufacture.*—The method of manufacture at present employed is somewhat primitive. A portable withering tat has been constructed and is now in use, but the results so far obtained are not altogether satisfactory. There are no facilities at present for artificial withering, consequently it is almost impossible to obtain good tea during the wet season since practically no drying of the leaf takes place. The air being saturated with moisture the leaf structures, instead of withering naturally, begin to decompose.

The rolling is being carried out by hand, which is not very satisfactory. A small hand-power roller has, however, been ordered from Colombo, while a small drying kiln is now under construction, so that considerable improvement in the manufacture may shortly be expected.

*Shade Trees and Windbreaks.*—During November, 1928 seedlings of *Grevillea robusta* were planted at distances of 40 ft. apart in the rows between the plots, so as to give auxilliary shade and act as a windbreak.

*Cover Plants.*—Experiments are being conducted with the planting of cover plants so that observations can be made on the growth of the tea under cover plants compared with growth on clean-weeded areas. The cover plants under trial at present include *Centrosema pubescens, Dolichos Hosei* and *Indigofera endecaphylla.*

Manipuri Tea, four years old, at the Experimental Plantation, Serdang.

*Diseases and Pests.*—Although isolated cases of a root disease, causing a rot, have occurred from time to time no serious diseases or pests have so far been recorded on these experimental plots.

*Vegetative Propagation.*—Experiments are now being conducted at Serdang with the object of multiplying stocks of tea by means of vegetative reproduction and the following methods are being adopted for this purpose:—

(1) The striking of cuttings from prunings.
(2) "Gootee" layering of the outside lower branches of the tea bushes.

The experiments have already been attended with a certain amount of success and may prove of considerable value in connection with the propagation of high yielding types.

## Experiments at the Experimental Plantation, Cameron's Highlands.

In January, 1925 a small consignment of seed of three varieties of tea was received from Assam for planting at the Experimental Plantation, Serdang and 200 seeds of each variety were taken up to Cameron's Highlands by Mr. J. N. Milsum, Assistant Agriculturist, when on a visit of inspection towards the end of that month. These seeds were sown in prepared nursery beds on low-lying land at the Experimental Plantation, Tanah Rata. Germination was good and in January, 1926, 437 seedlings raised from this stock of seed were planted out on a small plot of land, facing the office and store, in Block D. 1. The elevation of these plots is approximately 4,650 feet above sea level and the distance of planting is 4 ft. x 4 ft., which gives 2,722 plants per acre.

The following particulars show the varieties and number of seedlings comprising these plots:—

| | Jat. | No. of Plants. |
|---|---|---|
| Plot A. | Betjan | 180 |
| Plot B. | Dhonjan | 140 |
| Plot C. | Rajghur | 117 |

The following measurements were taken of the four largest plants in January, 1927, which was exactly one year after planting out in the field:—

| | | | |
|---|---|---|---|
| Bush No. 1 | 4 ft. 10 ins. high | 2 ft. 6 ins. | spread. |
| ,, 2 | 4 ft. 10 ins. ,, | 3 ft. 0 ins. | ,, |
| ,, 3 | 4 ft. 4 ins. ,, | 2 ft. 3 ins. | ,, |
| ,, 4 | 3 ft. 11 ins. ,, | 2 ft. 8 ins. | ,, |

The pruning of the above plots prior to plucking was undertaken in April, 1927 and actual plucking operations commenced on the 24th July, 1927. The bushes were cropped regularly from this date at intervals of 9 to 10 days. During the twelve months ending the 23rd July, 1928 the total weight of dry tea harvested amounted to 78 lbs. 6 ozs. Taking the area of these plots as 1/6 of an acre this is equivalent to a yield of 470 lbs. of made tea per acre during the first year of cropping. The growth of these bushes in October, 1928 is shown in Plate II.

Although it is somewhat dangerous to place much reliance on calculated yields the figures quoted above are sufficiently high to allow of a big margin of error in estimating the probable yields which may reasonably be expected on the highlands.

In January, 1927 a consignment of a ¼ maund of seed of the Muttapong Manipuri variety was received from Assam, through Messrs E. S. Stewart & Co., Calcutta, and contained 4,756 seeds, which were planted in baskets on the 15th January. This is a dark leaf Manipuri variety. The seeds were planted up in baskets and germination commenced on the 20th February.

At the end of June, 1927 only 1,215 seedlings had been established in baskets, which was a very poor rate of germination. Owing to the bamboo baskets showing signs of falling away from the plants, with a consequent drying out of the soil, these seedlings were planted out in July, 1927 on terraced land, in Block E. 1, with satisfactory results.

In March, 1927 another consignment of seed was received from Assam, through Messrs E. S. Stewart & Co., Calcutta, and comprised the following varieties:—

(1) *Charali Manipuri.*—A pure Manipuri plant having a dark leaf.

Tea bushes, four years old, at the Experimental Station, Cameron's Highlands.

(2) *Charali Assam.*—A pure Assam variety having broad leaves of medium colour.

(3) *Amulguri.*—Pure indigenous dark leaf Assam plant.

(4) *Dutea Manipuri.*—A pure Manipuri variety.

The above seeds were sown direct in nursery beds in March, 1927 and the following results of germination were obtained:—

| Jat. | | Quantity of seed received. | No. of seedlings established. |
|---|---|---|---|
| Charali Manipuri | ... | ¼ maund | 2,620 |
| Charali Assam | ... | ,, | 2,608 |
| Amulguri | ... | ,, | 2,780 |
| Dutea Manipuri | ... | ,, | 1,957 |

It should be stated here that as a large number of seeds were broken and others had already commenced to germinate it was impossible to record the number of seeds received in this consignment.

All these seedlings were planted out in Blocks D. 1—E. 1 on Spur No. 3 during the interval between the middle of November and end of December, 1927. The first pruning operation took place on these plots during August, 1928.

The following are particulars of additional tea seed received at the end of 1927 and beginning of 1928, which comprises the present stock of 60,000 seedlings in the nurseries, (see Plate III).

In December, 1927 an additional consignment consisting of 1 maund of Charali Assam seed was received from Assam, through Messrs E. S. Stewart & Co., Calcutta. The results of germination were as follows:—

| Jat. | Quantity of seed. | No. of seeds received. | No. of seedlings established. | Percentage germination. |
|---|---|---|---|---|
| Charali Assam | 1 maund | 14,302 | 13,242 | 93 |

These seedlings are still in the nursery beds, but an area of land is now being prepared on the western slope of Spur No. 3 for planting up a one acre plot of this variety. A duplicate plot of the same variety is to be planted up on the opposite slope of this spur later on.

In January, 1928 a still further consignment consisting of 4 maunds of seed was received from Assam, through the Planters' Stores & Agency Co., Ltd., Calcutta. The results of germination were as follows:—

| Jat. | Quantity of seed. | No. of seeds received. | No. of seedlings established. | Percentage germination. |
|---|---|---|---|---|
| Betjan | 1 maund | 13,000 | 12,254 | 94 |
| Dhonjan | ,, | 11,024 | 10,716 | 97 |
| Rajghur | ,, | 14,000 | 13,610 | 97 |
| Dangri | ,, | 10,340 | 8,394 | 81 |

As stated above, these seedlings are still in the nursery beds and will soon be ready for planting out in the field. An area of about 4 acres on the western slope of Spur No. 3 in Block E. 1 has been clean cleared and holed ready for planting up one acre plots of each of the above varieties, while instructions have been given to prepare a similar area on the eastern slope of this spur for planting up duplicate plots as early as possible.

*Diseases and Pests.*—The plants have not yet suffered from any serious diseases or pests, but one or two cases of root disease have been observed, specimens of which have been submitted to the Mycologist for investigation.

### General.

Since writing the above memorandum 5 maunds (400 lbs.) of tea seed have been received from Assam for planting at the Experimental Plantation, Serdang, while a further 5 maunds of low-country tea seed have been ordered from Ceylon for the same purpose and delivery is expected within the next few weeks.

Allowing for 1 maund (80 lbs.) of seed being required to plant up 3 acres of land the above supply of tea seed should provide sufficient seedlings to plant up a further area of about 30 acres at Serdang.

The following tea machinery has since been received at the Experimental Plantation, Serdang:—

1 "Little Giant" Tea Roller (capacity 60 lbs. withered leaf per charge).

1 Roll Breaker, 9 feet long.

1 Tea Cutter, fitted with $\frac{3}{8}$ cells.

Tea nurseries at the Experimental Plantation, Cameron's Highlands.

In addition to the above, a set of hand sieves and a supply of jute hessian have been received, which will be sufficient for carrying out preliminary experiments in the manufacture of tea from the 5 one-acre plots now in bearing at Serdang. As soon as this machinery has been installed it is intended to prepare representative samples of lowland tea and obtain, with the assistance of the Malay States Information Agency, a report on its quality and commercial value.

A sample of hand made tea produced from 4 year-old plants growing at the Experimental Plantation, Serdang was recently submitted to Messrs. Whittall & Co., Colombo, who made the following report and valuation on the sample in question:—

*Liquor.*—Has good colour, but tastes somewhat burnt.

*Leaf.*—Even leaf, fairly well twisted, has a good show of tip.

*Special Comment.*—This sample represents good merchantable tea and is probably worth about 1/6d. to 1/7d. if sold in London. The quality of the tea is similar to an Indian tea from the Cachar District.

At the Experimental Plantation, Cameron's Highlands a further area of about 5½ acres has since been planted up with the Betjan (3¾ acres) and Dangri (1¾ acres) varieties of tea.

A sample of 8 lbs. of hand-made tea produced from three-year-old plants grown at the Experimental Plantation, Cameron's Highlands, was forwarded to the Agent, Malay States Information Agency, London, on the 18th December, 1928 with a request that he would submit samples to one or two London Tea Brokers with a view to obtaining a valuation and report on the quality as compared with similar tea produced on the higher ranges in India and Ceylon.

# Tea Growing in the Sungei Besi District of Selangor.

J. N. Milsum.

In view of the interest now being shown in the cultivation of tea in the Malay Peninsula, it is thought that a brief description of the cultivation of this crop and preparation of the product for consumption, by Chinese settlers, is worth recording. In the Sungei Besi District of Selangor, small areas of tea are frequently seen. There is a large Chinese population in this district on account of the extensive tin mining operations in the Sungei Besi Valley. In the Sungei Balak Chinese Settlement, which is an area of 360 acres adjoining the Sungei Besi—Cheras road, a considerable amount of land is under cultivation with tea, approximating 140 acres. Some tea is also cultivated at the Bukit Serdang Chinese Settlement at Sungei Ramal in the Kajang district.

## Chinese Small-holders.

The Chinese small-holders in the Sungei Balak Settlement are Khehs and are familiar with the cultivation and preparation of tea as practised in China. The area of land occupied by each small-holder in the settlement varies from 2 to 5 acres, which is worked by himself and his family, but Chinese women are often engaged for plucking.

In addition to tea a variety of fruits are cultivated, including pineapples, Jack-fruit, rambutan, pulasan and coconuts. Certain of these trees provide some shade for the tea bushes, but generally no systematic shading is undertaken. The tea bushes under shade presented a more healthy appearance than those in full sun.

The settlement is situated on sharply undulating land with some steep hills. No silt-pitting or drains have been constructed with the result that considerable erosion of surface soil has taken place. On some of the steepest slopes the tea bushes are planted on narrow terraces. The soil may be described as a clay loam and is similar in appearance to the usual "bukit" land obtaining in Selangor.

### Source of Seed.

Enquiries as to the origin of seed from which the tea bushes were raised elicited the reply that the original seed was brought over from China and planted in various districts in the locality, from whence the seed had been obtained. No regular seed-bearers were seen, but many of the bushes were flowering and fruits in various stages of maturity were observed. It was stated that seeds were sometimes collected for sale and realized about 18 cents per catty (13½ cents per lb.) A fair sample of such seeds was stated to give 50 per cent. germination under favourable conditions.

### Appearance of Bushes.

The appearance of the bushes varies considerably, due to a certain extent to soil erosion. Further, plucking is coarse and irregular resulting in poor flushes. There was evidence, however, that many mixed "jats" comprised the bushes under cultivation. The mature leaf of the majority of bushes is small and the tips often of a reddish colour resembling what is known in Ceylon as "China jat". The leaf of others is considerably larger and in certain cases measure 5.5 ins. in length and 2.25 ins. in breadth. These bushes are robust and vigorous growing.

### Nursery Beds.

Only one nursery of seedlings was seen, this was formed under the shade of fruit trees and sheltered with a rough "attap" fence erected round the beds. It was stated that the seedlings are allowed to remain in the nursery beds for six months when they are transplanted to the open land during favourable weather.

### Method of Planting.

The land for planting is usually brought into cultivation from "lalang" and "blukar", there being little or no timber to burn off. The usual planting distance is 3½ ft. by 3½ ft. though frequently quite irregular planting is undertaken. Weeding is done as necessary, but "lalang" is evident and apparently only removed when it becomes heavy.

Pruning during the early stages of the seedling's growth is usually undertaken, but as plucking often commences when the seedlings are eighteen months old, the bushes have small chance of becoming well-formed. When the bushes grow to some size and commence to flower they are cut back to within 2 to 3 feet from the ground. This form of pruning was stated to be undertaken about every two years.

No contour drains or silt-pits were seen and for this reason the surface soil has suffered severely from erosion. Where erosion has been particularly severe the bushes are stunted and make little growth. The bushes are not manured in any way.

As already stated, plucking is said to commence when the bushes have been planted out for one year. This operation is usually done by Chinese women, who receive payment at the rate of 5 cents per catty (about 4 cents per lb.) of green leaf collected. The women are able to collect from 12 catties to 15 catties (16 to 20 lbs.) of green leaf per diem according to season and other conditions. Plucking is only done during the morning so as to enable the process of manufacture to commence during the afternoon. Fairly coarse plucking is undertaken and a large amount of stalk is allowed to go into the plucking basket. Plucking appears to be done about every ten days.

## Method of Manufacture.

The apparatus used for the manufacture of the leaf into tea is simple. An iron pan, measuring 3 feet in diameter, as employed by Chinese for cooking rice, and costing about five dollars (Straits currency), is built over a brick or clay oven about 3½ feet square and 2½ feet high. No chimney is provided to take off the smoke from the wood fire. In some cases a second pan is built in at right angles to the first pan forming a hood. This allows the drying leaves to be stirred by means of a stirring-rod suspended above the oven, without the leaves falling over the side of the pan.

Various means are employed to dry the leaf, but it was stated that the best results are obtained by drying the leaf over a brisk fire without the aid of sun-drying. The system commonly in use is to wither the fresh leaf in the heated pan for about 20 minutes. The leaf is then removed and

rolled by hand in strong bamboo baskets or on a bamboo frame for about 20 to 30 minutes. The leaf is next placed in trays or flat baskets and put in the sun for about 6 hours. After this operation the leaf is sorted into two grades, i.e., tips and first leaf, and large leaf and stalks. Final firing then takes place over a brisk fire for 2 to 3 hours according to conditions. The leaf is constantly stirred and some skill is shown in doing this. The two grades of tea are then stored in empty kerosine tins until sold.

### Yield of Dry Tea.

Very variable crops are obtained, but it appeared that about 30 catties (40 lbs.) of made tea per acre per month is an average crop throughout the year. It is considered that about $3\frac{1}{2}$ piculs (466 lbs.) of dried tea per acre per annum is an average yield. The present price received locally for this tea is stated to be 68—75 cents per catty (51—56 cents per lb.) for the first quality leaf and 38—45 cents per catty (28—34 cts. per lb.) for the second quality. The price of this tea is stated to be lower than formerly owing to the present condition of the tin and rubber markets.

The principal buyers of locally produced tea are Chinese tin mine owners, who prepare and supply tea to their coolies working on the mines. It is stated that a demand for this tea exists in Penang and Seremban, where large quantities are forwarded.

### Quality of Tea.

The prepared tea is greyish-green in colour and very rough in appearance. The first quality is composed of rolled tips, the first leaf and some stalks. The smell of the leaf is faint and rather smoky. The tea would pass through a half-inch mesh sieve. The infusion is light brownish-green in colour. Taste harsh and bitter. The second grade is mainly composed of portions of large leaf and stalks which would pass through an inch mesh sieve. The infusion is weaker than that from the first grade tea.

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## Observations on Oil Palms.

T. D. Marsh.

In previous papers published in this Journal (1) and (2) the results were given of an experiment in the pollination of the oil palm, *Elaeis guineensis* Jacq., carried out at the Government Experimental Plantation, Serdang, during the years 1925 and 1926.

A summary of the above papers is given below:—

(1) An avenue of 86 oil palms of the Deli type, planted in May, 1922 in rows 36 feet apart at a distance of 30 feet apart in the rows, was utilized for a pollination experiment from the time they commenced to fruit (August, 1924) until the end of the year 1926.

(2) Forty three palms on one side of the avenue were pollinated artificially, while those on the other side served as controls.

(3) The yields of fruit from the two sets of palms were recorded.

(4) The records for the years 1925 and 1926 showed a much greater yield of fruit from the pollinated palms than from the control palms.

(5) The height, spread and circumference at the base of each palm were recorded and the average measurements of the two sets of palms showed no material differences in 1925 or 1926.

### Third Year's Record.

The present paper gives the results of a continuation of the observations to the end of the year 1927, together with comparisons drawn from the records of the two preceeding years.

The number of inflorescences artificially pollinated on each palm was limited, as in previous years, to a maximum

(1) Malayan Agricultural Journal, Vol. XIV, 1926, p. 384.
(2) *Loc cit.*, Vol. XVI, 1928, p. 20.

of one per month and only three palms out of forty-three artificially pollinated, as against fourteen of the naturally pollinated control palms, produced twelve or more bunches of fruit during the year.

A "bunch" was recorded whenever fruit was produced, even if the harvested weight of cleaned fruit was only one pound.

The number of artificially pollinated inflorescences which produced fruit was 253 out of a total pollinated of 331, which gives a pollinating efficiency of 76.4 per cent.

Allowing for the pollination of one inflorescence per palm per month, theoretically 516 inflorescences would have been pollinated, but palms failed to produce female inflorescences during many months of the year, consequently they did not have their maximum number of twelve pollinated.

The average number of inflorescences artificially pollinated was 7.7 per palm and the average number of bunches of fruit produced as a result of artificial pollination was 5.9 per palm.

It should be stated, however, that on the artificially pollinated palms a further 136 bunches of fruit matured as a result of natural pollination on palms which produced more than one female inflorescence per month during certain months of the year, thus giving an average production of 9.0 bunches per palm over the whole year.

The forty-three control palms averaged 9.1 bunches of fruit per palm for the same period.

The pruning of the palms was limited to the removal of those basal leaves which were turning brown or yellow, it being assumed that at this stage they had ceased to function. Harvesting of fruit was not permitted to influence the rate of pruning. The stalks of fruit bunches were severed with a mallet and a sharp chisel, about three inches wide, the bunch afterwards being removed from the axil of the leaf.

The pressure of one or more leaves on the growing fruit did not appear to influence the development of the bunches, but often a bunch of fruit became large enough to exert sufficient pressure on the leaf immediately below for that leaf to touch the next lower leaf. The pressure, however, only occurred on one of the outside edges of the lower leaf and the tendency was for such leaves to be pushed to one side out of the line of the exerting force of the growing bunch of fruit.

The inflorescences of the oil palm are produced in the axils of leaves, in sequence from below upwards, following the production of leaves in the normal growth of the palm. It was observed in a few instances, however, that female inflorescences developed in the next higher whorl of leaves about two months earlier than those in the axils of lower leaves.

## TABLE I.

### Yields from Pollinated Palms, 1927.

| Palm No. | No. of mature bunches. | Total weight of bunches. | | Total weight of fruits. | | No. of fruits. |
|---|---|---|---|---|---|---|
| | | lbs. | ozs. | lbs. | ozs. | |
| 1 | 8 | 201 | 4 | 133 | 10 | 5576 |
| 3 | 11 | 369 | — | 264 | 5 | 8812 |
| 5 | 9 | 348 | — | 231 | 15 | 8850 |
| 7 | 10 | 323 | 8 | 228 | 8 | 8485 |
| 9 | 10 | 300 | 8 | 207 | 14 | 8024 |
| 11 | 9 | 173 | 12 | 93 | 7 | 3985 |
| 13 | 6 | 113 | 8 | 72 | 3 | 3049 |
| 15 | 13 | 118 | — | 73 | 9 | 4516 |
| 17 | 11 | 143 | — | 96 | 15 | 3337 |
| 19 | 10 | 218 | 12 | 138 | 8 | 5473 |
| 21 | 9 | 275 | — | 189 | 12 | 5649 |
| 23 | 15 | 361 | — | 247 | 7 | 9326 |
| 25 | 9 | 160 | 12 | 103 | 12 | 4346 |
| 27 | 9 | 428 | 4 | 285 | 6 | 10934 |
| 29 | 10 | 80 | 8 | 55 | 3 | 4278 |
| 31 | 6 | 235 | 4 | 159 | 14 | 7424 |
| 33 | 12 | 228 | — | 156 | 4 | 7179 |
| 35 | 8 | 175 | 12 | 115 | 6 | 4036 |
| 37 | 12 | 399 | 8 | 281 | 9 | 8817 |
| 39 | 10 | 158 | 12 | 111 | 7 | 4122 |
| 41 | 1 | 21 | — | 15 | — | 440 |
| 43 | 8 | 152 | 10 | 104 | 6 | 4240 |
| 45 | 3 | 49 | 14 | 32 | 10 | 1598 |
| 47 | 14 | 251 | 8 | 156 | 14 | 5129 |
| 49 | 10 | 149 | 4 | 92 | 7 | 3253 |
| 51 | 9 | 169 | — | 113 | 4 | 4629 |
| 53 | 8 | 132 | — | 83 | 1 | 3130 |
| 55 | 10 | 153 | 14 | 101 | 3 | 4129 |
| 57 | 12 | 365 | — | 258 | 3 | 9862 |
| 59 | 10 | 158 | 12 | 94 | 6 | 3147 |
| 61 | 8 | 165 | 8 | 110 | 10 | 4416 |
| 63 | 10 | 149 | 12 | 100 | 12 | 3745 |
| 65 | 10 | 252 | — | 164 | 4 | 5305 |
| 67 | 11 | 300 | 14 | 204 | 11 | 7398 |
| 69 | 9 | 145 | 8 | 99 | 5 | 4466 |
| 71 | 7 | 162 | 10 | 114 | 15 | 3575 |
| 73 | 7 | 142 | 12 | 99 | 3 | 4479 |
| 75 | 7 | 138 | 4 | 90 | 12 | 3294 |
| 77 | 3 | 67 | 8 | 47 | 1 | 2083 |
| 79 | 8 | 172 | 12 | 116 | 1 | 6098 |
| 81 | 9 | 205 | 8 | 140 | 13 | 7057 |
| 83 | 10 | 171 | 10 | 108 | 9 | 3462 |
| 85 | 8 | 176 | 10 | 102 | 14 | 4992 |
| | 389 | 8,666 | 2 | 5,798 | 2 | 226,145 |

## TABLE II.

### Yields from Control Palms, 1927.

| Palm No. | No. of mature bunches. | Total weight of bunches. | | Total weight of fruits. | | No. of fruits. |
|---|---|---|---|---|---|---|
| | | lbs. | ozs. | lbs. | ozs. | |
| 2 | 3 | 22 | 6 | 3 | 3 | 53 |
| 4 | 6 | 121 | 8 | 61 | 1 | 1042 |
| 6 | 4 | 26 | 8 | 3 | — | 130 |
| 8 | 3 | 21 | 4 | 11 | 9 | 460 |
| 10 | 9 | 132 | 10 | 63 | 11 | 1776 |
| 12 | 4 | 39 | 12 | 13 | 12 | 492 |
| 14 | 11 | 75 | 12 | 21 | 14 | 818 |
| 16 | 2 | 9 | 4 | 1 | 14 | 67 |
| 18 | 9 | 83 | — | 18 | 5 | 521 |
| 20 | 12 | 81 | 10 | 24 | 2 | 726 |
| 22 | 6 | 56 | 4 | 12 | 4 | 507 |
| 24 | 6 | 60 | 12 | 22 | 8 | 649 |
| 26 | 15 | 157 | 8 | 53 | 8 | 1621 |
| 28 | 18 | 326 | 6 | 166 | 10 | 5727 |
| 30 | 5 | 28 | — | 6 | 7 | 198 |
| 32 | 10 | 68 | 12 | 29 | 7 | 1209 |
| 34 | 6 | 60 | 4 | 21 | 3 | 752 |
| 36 | 9 | 78 | 14 | 32 | — | 1000 |
| 38 | 5 | 34 | 12 | 9 | 9 | 333 |
| 40 | 2 | 10 | 12 | 3 | — | 78 |
| 42 | 5 | 84 | — | 45 | 10 | 2173 |
| 44 | 20 | 240 | 10 | 101 | 5 | 3123 |
| 46 | 3 | 22 | 12 | 6 | 10 | 213 |
| 48 | 3 | 21 | 8 | 4 | 8 | 148 |
| 50 | 5 | 36 | 8 | 16 | 8 | 588 |
| 52 | 11 | 158 | 6 | 78 | 15 | 2477 |
| 54 | 15 | 136 | 12 | 34 | 12 | 958 |
| 56 | 11 | 160 | 4 | 79 | 3 | 2469 |
| 58 | 14 | 107 | 6 | 24 | 3 | 733 |
| 60 | 20 | 315 | — | 134 | 5 | 4544 |
| 62 | 3 | 11 | 4 | 3 | 7 | 114 |
| 64 | 12 | 110 | 6 | 31 | 5 | 929 |
| 66 | 17 | 257 | 4 | 54 | 7 | 2209 |
| 68 | 13 | 87 | — | 35 | 14 | 1099 |
| 70 | 2 | 30 | 12 | 7 | 4 | 314 |
| 72 | 13 | 136 | 8 | 72 | 11 | 2244 |
| 74 | 10 | 159 | 12 | 80 | 2 | 3336 |
| 76 | 20 | 218 | 12 | 77 | 6 | 2754 |
| 78 | 11 | 50 | 4 | 20 | 5 | 1160 |
| 80 | 12 | 184 | 8 | 92 | 1 | 3837 |
| 82 | — | — | — | — | — | — |
| 84 | 3 | 32 | — | 7 | 6 | 508 |
| 86 | 13 | 107 | 10 | 27 | 9 | 1178 |
| | 381 | 4,165 | — | 1,614 | 11 | 55,267 |

## TABLE III.

SUMMARY OF TABLES I & II AND COMPARISONS WITH 1925 AND 1926 YIELDS.

| Particulars. | 1925 | | 1926 | | 1927 | |
|---|---|---|---|---|---|---|
| | Artificially pollinated palms. | Control palms. | Artificially pollinated palms. | Control palms. | Artificially pollinated palms. | Control palms. |
| Number of palms - | 43 | 43 | 43 | 43 | 43 | 43 |
| Number of productive palms - | 40 | 39 | 43 | 43 | 43 | 42 |
| Number of bunches harvested - | 349 | 137 | 546 | 407 | 389 | 381 |
| Average number of bunches per fruiting palm - | 8.7 | 3.5 | 12.7 | 9.5 | 9.0 | 9.1 |
| Total weight of bunches - | 3,116 lbs. | 776 lbs. | 7,821 lbs. | 2,926 lbs. | 8,666 lbs. | 4,165 lbs. |
| Total weight of fruits - | 1,951 ,, | 379 ,, | 5,163 ,, | 902 ,, | 5,798 ,, | 1,615 ,, |
| Average weight of fruits per yielding palm - | 48.8 ,, | 9.7 ,, | 120.1 ,, | 21.0 ,, | 134.8 ,, | 38.5 ,, |
| Total number of fruits - | 97,272 | 17,158 | 212,892 | 35,821 | 226,145 | 55,267 |
| Number of fruits per lb. - | 50.0 | 45.3 | 41.2 | 39.7 | 39.1 | 34.2 |
| Average weight of bunches - | 8.9 lbs. | 5.7 lbs. | 14.3 lbs. | 7.2 lbs. | 22.3 lbs. | 10.9 lbs. |
| Average weight of fruits per bunch - | 5.7 ,, | 2.8 ,, | 9.5 ,, | 2.2 ,, | 14.9 ,, | 4.2 ,, |

The figures in Table III show that there has been a progressive increase in yield from both sets of palms during the year, only one palm in the eighty-six under experiment failing to produce fruit.

The number of bunches harvested on each side of the avenue is less than that recorded during 1926, but the total weight of fruit produced is considerably greater. This suggests that as the palms get older, whether artificially pollinated or not, fewer bunches are produced per palm, but the average weight per bunch is greater.

During the year 1927 the control palms have almost doubled their yield over that of 1926. This is probably due to palms growing higher, consequently the leaves do not prevent the wind-borne pollen from reaching the flowers to the same extent as formerly.

The control palms have during 1927 increased their yield of fruit at a faster rate than the artificially pollinated palms, thus lessening the great disparity between the yields of the two sets of palms.

The increase in yield over that of 1926 of the artificially pollinated palms averages 15 lbs. of fruit per palm and is more than 250 per cent. heavier than that of the controls, or over 3½ times as great. During the year 1925 the ratio of the weight of fruit harvested from the two sets of palms was 5 to 1. The yield from the artificially pollinated palms is equal to the estimated production of palms over ten years old growing under average plantation conditions, although the system of artificial pollination is very moderate.

The amount of fruit harvested from the control palms is very low, but, as pointed out in previous papers on this experiment, it is in all probability due to the avenue conditions and general lack of pollen.

The size of the fruit has increased in comparison with previous years, as indicated by the number of fruits per pound. The control plot, which yielded the smaller number of fruits, has an average weight approaching half an ounce per fruit.

The average weight of cleaned fruit obtained from the artificially pollinated inflorescences during the year 1927 was 18.1 lbs. per bunch, but allowing for the additional 136 bunches which developed on the pollinated palms as the result of natural pollination, the average weight of fruit per bunch is reduced to 14.9 lbs.

The average weight of cleaned fruit from the control palms for the same period was 4.2 lbs. per bunch.

## Measurements of Palms.

The following measurements of the palms on both sides of the avenue, taken at the end of the year 1927, are recorded: —

## TABLE IV.

| POLLINATED PALMS | | | | | | | CONTROL PALMS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Palm No. | Height | | Spread | | Circumference at base | | Palm No. | Height | | Spread | | Circumference at base | |
| | ft. | ins. | ft. | ins. | ft. | ins. | | ft. | ins. | ft. | ins. | ft. | ins. |
| 1 | 29 | 0 | 36 | 4 | 9 | 5 | 2 | 30 | 0 | 36 | 8 | 9 | 10 |
| 3 | 28 | 0 | 32 | 8 | 9 | 2 | 4 | 28 | 8 | 35 | 6 | 9 | 8 |
| 5 | 26 | 8 | 37 | 8 | 9 | 4 | 6 | 23 | 0 | 32 | 0 | 8 | 0 |
| 7 | 26 | 4 | 37 | 4 | 8 | 10 | 8 | 22 | 0 | 30 | 0 | 7 | 10 |
| 9 | 26 | 0 | 35 | 6 | 8 | 8 | 10 | 28 | 0 | 35 | 6 | 9 | 4 |
| 11 | 21 | 8 | 26 | 4 | 9 | 2 | 12 | 20 | 0 | 28 | 6 | 8 | 0 |
| 13 | 21 | 0 | 29 | 8 | 8 | 6 | 14 | 18 | 0 | 25 | 0 | 7 | 4 |
| 15 | 18 | 0 | 23 | 8 | 7 | 10 | 16 | 22 | 4 | 29 | 0 | 7 | 7 |
| 17 | 20 | 0 | 27 | 4 | 7 | 0 | 18 | 28 | 0 | 35 | 8 | 9 | 4 |
| 19 | 25 | 8 | 32 | 6 | 8 | 7 | 20 | 21 | 0 | 28 | 8 | 7 | 10 |
| 21 | 25 | 0 | 31 | 12 | 8 | 8 | 22 | 23 | 0 | 29 | 0 | 8 | 2 |
| 23 | 28 | 8 | 35 | 8 | 8 | 2 | 24 | 24 | 8 | 30 | 2 | 8 | 7 |
| 25 | 19 | 4 | 27 | 6 | 7 | 0 | 26 | 24 | 0 | 31 | 8 | 8 | 4 |
| 27 | 27 | 0 | 36 | 8 | 9 | 3 | 28 | 26 | 4 | 33 | 8 | 9 | 2 |
| 29 | 18 | 0 | 24 | 4 | 7 | 3 | 30 | 22 | 0 | 31 | 8 | 8 | 4 |
| 31 | 22 | 8 | 38 | 0 | 8 | 5 | 32 | 21 | 0 | 29 | 4 | 8 | 2 |
| 33 | 23 | 4 | 28 | 4 | 7 | 6 | 34 | 21 | 0 | 31 | 0 | 8 | 4 |
| 35 | 24 | 8 | 33 | 8 | 8 | 0 | 36 | 22 | 4 | 30 | 0 | 8 | 4 |
| 37 | 26 | 0 | 34 | 0 | 8 | 3 | 38 | 22 | 0 | 29 | 8 | 7 | 10 |
| 39 | 21 | 0 | 30 | 6 | 7 | 2 | 40 | 18 | 0 | 27 | 0 | 7 | 10 |
| 41 | 15 | 0 | 18 | 8 | 6 | 0 | 42 | 19 | 0 | 29 | 4 | 7 | 10 |
| 43 | 23 | 0 | 29 | 8 | 8 | 0 | 44 | 24 | 4 | 30 | 4 | 9 | 6 |
| 45 | 18 | 0 | 27 | 0 | 7 | 3 | 46 | 28 | 8 | 34 | 8 | 8 | 10 |
| 47 | 23 | 0 | 32 | 4 | 8 | 0 | 48 | 26 | 8 | 34 | 2 | 8 | 8 |
| 49 | 24 | 0 | 30 | 8 | 7 | 8 | 50 | 23 | 0 | 30 | 8 | 7 | 10 |
| 51 | 22 | 0 | 29 | 4 | 7 | 0 | 52 | 27 | 8 | 34 | 4 | 10 | 0 |
| 53 | 21 | 8 | 30 | 0 | 7 | 7 | 54 | 27 | 8 | 35 | 4 | 9 | 10 |
| 55 | 23 | 0 | 31 | 4 | 7 | 4 | 56 | 27 | 8 | 33 | 8 | 10 | 0 |
| 57 | 26 | 0 | 33 | 8 | 8 | 6 | 58 | 26 | 8 | 33 | 2 | 9 | 7 |
| 59 | 22 | 0 | 37 | 4 | 7 | 8 | 60 | 26 | 0 | 33 | 0 | 9 | 4 |
| 61 | 18 | 0 | 27 | 8 | 7 | 6 | 62 | 22 | 0 | 30 | 0 | 8 | 2 |
| 63 | 16 | 0 | 26 | 4 | 7 | 0 | 64 | 23 | 4 | 30 | 8 | 8 | 8 |
| 65 | 26 | 4 | 34 | 0 | 8 | 2 | 66 | 23 | 8 | 30 | 0 | 9 | 0 |
| 67 | 24 | 0 | 33 | 4 | 9 | 0 | 68 | 18 | 0 | 24 | 4 | 7 | 4 |
| 69 | 20 | 4 | 28 | 0 | 7 | 6 | 70 | 18 | 8 | 25 | 4 | 8 | 0 |
| 71 | 22 | 0 | 31 | 4 | 7 | 10 | 72 | 18 | 8 | 27 | 0 | 7 | 0 |
| 73 | 17 | 4 | 24 | 8 | 8 | 6 | 74 | 17 | 4 | 24 | 6 | 8 | 10 |
| 75 | 19 | 0 | 25 | 4 | 9 | 8 | 76 | 16 | 8 | 28 | 0 | 8 | 8 |
| 77 | 17 | 0 | 24 | 2 | 7 | 8 | 78 | 14 | 4 | 22 | 2 | 7 | 10 |
| 79 | 16 | 0 | 24 | 0 | 8 | 10 | 80 | 19 | 0 | 28 | 0 | 10 | 0 |
| 81 | 18 | 0 | 24 | 4 | 8 | 6 | 82 | 17 | 4 | 24 | 8 | 10 | 4 |
| 83 | 18 | 0 | 24 | 8 | 9 | 0 | 84 | 20 | 0 | 24 | 2 | 8 | 2 |
| 85 | 20 | 0 | 29 | 0 | 8 | 0 | 86 | 18 | 0 | 24 | 0 | 8 | 10 |
| | 947 | 8 | 1296 | 6 | 348 | 4 | | 969 | 8 | 1291 | 2 | 370 | 1 |

The measurements recorded in Table III show the following comparisons with the figures recorded in 1925 and 1926:—

TABLE V.

| Particulars. | 1925 | | 1926 | | Increase in growth during 1926. | | 1927 | | Increase in growth during 1927. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pollinated Palms. | Control palms. | Pollinated Palms. | Control palms. | Pollinated. | Control. | Pollinated palms. | Control palms. | Pollinated | Control. |
| | ft. | ft. | ft. | ft. | ft. | ft. | ft. | ft. | ft. | ft. |
| Average height of palms - | 15.60 | 15.67 | 18.56 | 18.83 | 2.96 | 3.16 | 22.04 | 22.55 | 3.48 | 3.72 |
| Average spread of leaves (i.e. diameter) - | 21.49 | 21.70 | 28.16 | 27.78 | 6.67 | 6.08 | 30.15 | 30.03 | 1.99 | 2.25 |
| Average circumference at base of palms - | 6.45 | 6.63 | 7.19 | 7.57 | 0.74 | 0.94 | 8.10 | 8.61 | 0.91 | 1.04 |

The measurements summarised in Table V above show that the palms are well-developed for their age and that there is little difference in growth between the artificially pollinated and the non-pollinated palms, although the latter are slightly larger.

The heavy fruiting of the pollinated palms does not appear to have influenced the development of the palms to any great extent.

The increase in growth during the years 1926 and 1927 is recorded.

### Comparison of Monthly Yield and Rainfall.

A summary of the total monthly yield of cleaned fruit obtained from the two sets of palms under experiment, together with records of the rainfall for the year 1927, are given in the following table:—

## TABLE VI.

Summary of Monthly Yields and Rainfall Records, 1927.

| Month. | Yield of Cleaned Fruit. | | | | | | Rainfall Records. | |
|---|---|---|---|---|---|---|---|---|
| | Pollinated palms. | | Control palms. | | Total. | | No. of wet days. | Total rainfall. |
| | lbs. | ozs. | lbs. | ozs. | lbs. | ozs. | | ins. |
| January - | 205 | 1 | 25 | 1 | 230 | 2 | 21 | 11.15 |
| February - | 286 | 14 | 54 | 13 | 341 | 11 | 9 | 4.29 |
| March - | 502 | 4 | 116 | 6 | 618 | 10 | 16 | 13.82 |
| April - | 539 | 11 | 113 | 11 | 653 | 6 | 17 | 13.14 |
| May - | 455 | 4 | 76 | 11 | 531 | 15 | 6 | 6.49 |
| June - | 478 | 15 | 145 | 12 | 624 | 11 | 7 | 4.56 |
| July - | 470 | 13 | 60 | 8 | 531 | 5 | 3 | 1.11 |
| August - | 453 | 14 | 169 | 10 | 623 | 8 | 7 | 2.72 |
| September | 498 | 12 | 139 | 4 | 638 | 0 | 14 | 6.19 |
| October - | 745 | 15 | 343 | 11 | 1089 | 10 | 16 | 9.69 |
| November - | 697 | — | 217 | 8 | 914 | 8 | 14 | 16.09 |
| December - | 463 | 11 | 151 | 12 | 615 | 7 | 15 | 8.32 |
| Totals - | 5,798 | 2 | 1,614 | 11 | 7,412 | 13 | 145 | 97.57 |

SUMMARY.

(1) The third year's yields of oil palms growing under avenue conditions in an experiment on artificial pollination are recorded, observations made, and comparisons are drawn with the yields of an equal number of palms naturally pollinated.

(2) Although the results still show a large increase in yield due to artificial pollination there was a slight reduction during 1927 of the great disparity between the yields of the two plots as recorded during the years 1925 and 1926.

(3) Measurements of height, spread and circumference at the base of individual palms are included. The average of the figures obtained from each side of the avenue show little difference in the size of the palms.

(4) The increase in the growth of the two sets of palms during the years 1926 and 1927 is given.

(5) A summary of the total monthly yield of cleaned fruit obtained from the two sets of palms, together with records of the monthly rainfall for the year 1927, are also given for purposes of comparison.